

Design and Implementation of Intelligent Self Extracting Cabinet Control System

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Abstract—This paper describes the design and implementation of the intelligent self extracting cabinet control system, Master controller provides two ways that password pickup and pick up by card and provide humane voice prompts; provides bar code scanning mechanism-based inventory; support for intelligent cabinet system parameter setting. Master controller based on STM32F103, use the touch screen achieve human-computer interaction, Connection with a remote server via a network communication module and save critical data to FLASH chip, use RS485 module controller communicates with the child to achieve control of each cargo tank.

Keywords-STM32F103; touch screen; barcode scanning; RS485

I. INTRODUCTION

Especially the last mile of the distribution about fresh product distribution has been difficult to break through the technical bottleneck, which gives rise to the sale of fresh electricity supplier has brought a great deal of trouble. In view of the above shortcomings, smart fresh from mentioning cabinet system provides a cold storage type self lockers in machinery from mentioning cabinet is composed of several independent and a box door closed container, with refrigeration equipment and control system of intelligent cabinets from mentioning fresh complete from mentioning cabinet system, can from the cold chain storage on the locomotive after fresh products, and can provide consumers with fresh products 24 hours pick up service, avoid the attendant direct distribution to consumers in the process, so as to solve the logistics distribution chain of fresh products distribution problem, meet the development needs of the new logistics system with low energy consumption.

II. DESIGN REQUIREMENTS OF THE SELF LIFTING CABINET SYSTEM

Intelligent self extracting cabinet system is an important part of electronic commerce system, plays the role of

terminal distribution, e-commerce system set order management, warehouse management, transportation management, from the cabinet system management. The block diagram of online ordering system is shown in Fig. 1.

Consumers online orders, the goods management system to generate a barcode and inform the storage system for the packaging of goods, the goods from mentioning cabinet delivery to the consumer area re scheduling transportation system, distribution staff from mentioning cabinet system bar code on the packaging of the goods, from mentioning cabinet system will be sent to the server for the bar code through verification, verification of goods can be deposited in the management system, and then notify the consumer goods, consumer goods is finished, and then inform the server from mentioning cabinet system, management system is that the completion of the transaction order.

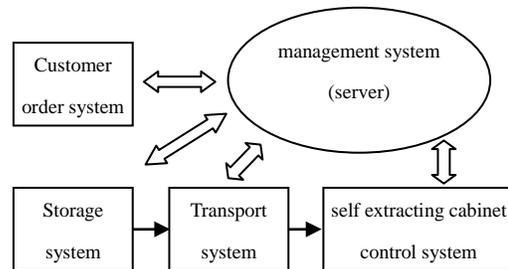


Figure 1. Block diagram of online ordering system

III. SYSTEM SCHEME DESIGN

Since the electronic control cabinet provided system needs to control a large number of locks, for flexible containers, from mentioning cabinet system uses a master-slave control mode. 10 cases as a group, each group had assigned a sub controller. Container door lock control and detection, temperature detection and switch controller responsible for compressor control group. The main controller is responsible for human-computer interaction,

Internet communication, voice broadcast, bar code scanning, RF card reader and data storage. The master slave controller can communicate with the RS485 bus [1], and the main controller controls the action of the sub node through the instruction. The system of overall structure is shown in Fig. 2.

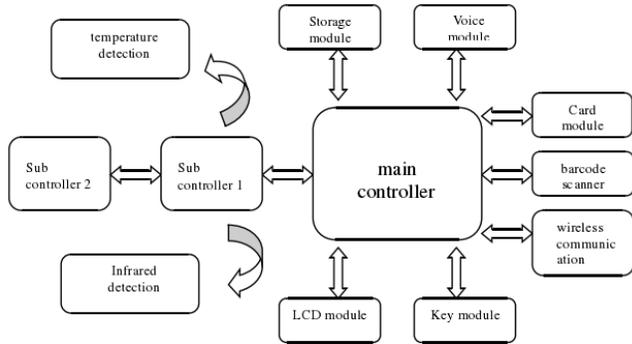


Figure 2. System of overall structure

The master slave controller selects the 32 bit STM32F103ZET6 of MCU as the control core. The performance of STM32 series STM32F103 series is an enhanced version of MCU, stable work, the highest clock frequency can reach 72MHZ, the characteristics of high performance, low power consumption, low cost and multiple serial port is very consistent with the needs of the system[2].

IV. MAIN CONTROLLER HARDWARE DESIGN

The hardware design of the main controller is mainly composed of three parts: power management design, MCU minimum system design and function module interface design.

A. Power Management Design

Power management with voltage monolithic switching regulator LM2596S-5.0 devices as step-down output 5V, although the number of modules on the main controller, but each module with low power consumption, so the chip 3A the maximum drive current is used. In the peripheral circuit of the chip, the input capacitor is 680uF, the output capacitor is 470uF, and the capacitance voltage is more than 2-3 times of the output voltage. L1 and C3 play a low-pass filtering effect, can further reduce the output voltage ripple[3].

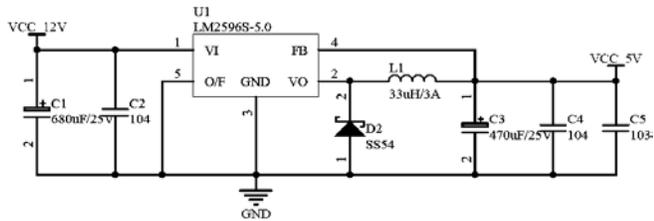


Figure 3. Power management design

B. MCU Minimum System Design

1) Clock circuit

MCU has a high speed clock, and needs to use PLL configuration MCU system clock frequency is in need of a high-speed external clock, in MCU OSC_IN and OSC_OUT

are connected across a high-speed quartz crystal oscillator, then matching resistor can be an oscillation circuit. In order to improve the precision and reduce the vibration stability time, will be as close as possible to the OSC_IN crystal and OSC_OUT two pin.

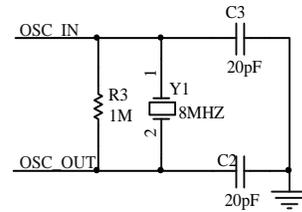


Figure 4. MCU external crystal oscillator circuit

2) Reset circuit

MCU NRST is reset pin, active low, in normal operation, this pin through the series resistor of 10K to generate a stable high level received power supply. Reset circuit as shown in Fig. 3-2.

3) SWD debug interface

There are two ways to download and debug the program, one is the JTAG interface, and the other is the SWD interface. SWD is a subset of the JTAG inheritance and SWD interface is relatively less than the required pins, as long as 4, and SWD in high speed stable performance. The SWD interface is connected with a pull resistor on the two signal pin, so as to prevent the floating of the level when the pin is left floating.

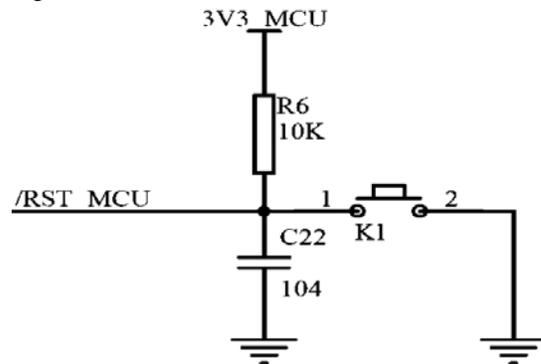


Figure 5. Reset circuit Tutu

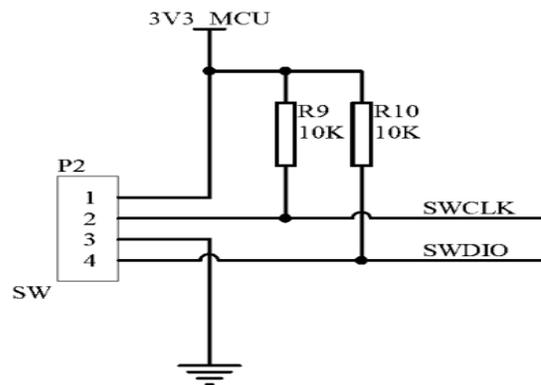


Figure 6. SWD interface circuit

C. Module Interface Design

1) Communication module in SPI mode

a) Ethernet communication module, serial port expansion module

Ethernet communication module and serial port expansion module using MCU and SPI3, in addition, the two modules have an interrupt output port, access to the MCU as an external interrupt signal input SPI2[4]. In the program, it is necessary to reset the operation of these two modules, so the reset pin of the module is managed to the MCU, and the reset pin is low. Ethernet communication module 3.3V power supply, serial port expansion module 5V power supply, two modules are directly welded on the main controller circuit board.

b) Storage module

The module is different than other modules, just a FLASH memory chip, using the MCU SPI1. In the MCU port SPI port four data ports are connected to the pull-up resistor, used to clamp, to ensure that the level of floating state does not destroy the data inside the chip.

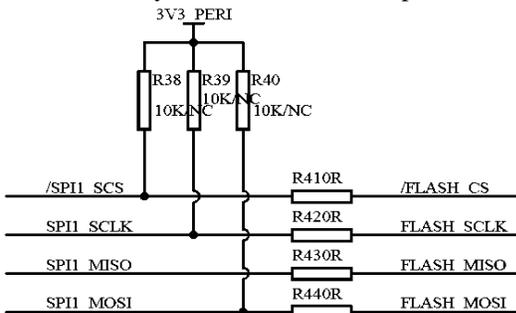


Figure 7. Memory chip interface

2) 3.2.2 serial communication module

a) RF card reader module

This module in addition to the two signal line of serial port and MCU serial port 1 is connected to another level MCU output port and a GPIO port used to connect the auxiliary communication module, when the induction to the card, the output level from the low level into a high level, this change can inform the current MCU card read. The module has a reset pin, the normal operation should be connected with the high level, the use of 3.3V power supply module, all pins connected by cable and main controller [5].

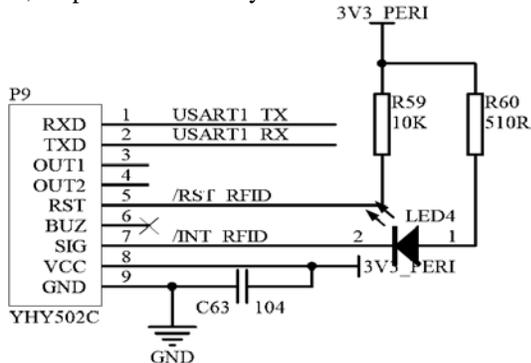


Figure 8. RF card reader module interface

b) Touch screen, GPRS module

Touch screen and GPRS module with the MCU serial port 4 and serial port 3, in addition to power supply, only the serial port of the RX and the TX signal pin needs to be connected, no other auxiliary communication feet two.

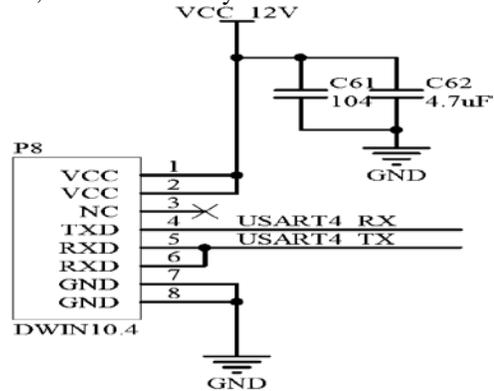


Figure 9. Touch screen interface

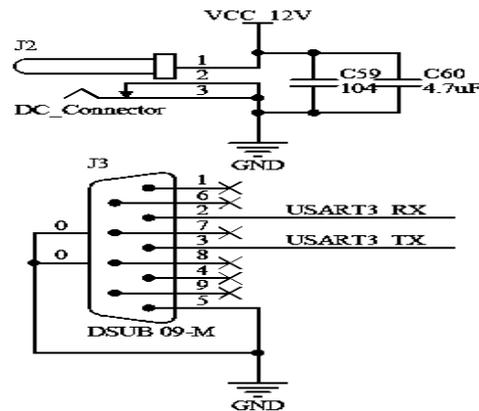


Figure 10. GPRS module interface

The touch screen and the GPRS module uses 12V power supply, power supply and signal line touch screen with cable is connected with the main controller through the GPRS module, a power supply socket separate, serial connection through DB9 standard connection line and main controller.

c) RS485 module

In addition to the serial port module, a data is sent to the end of a GPIO port to connect with the MCU module using the serial port 2 MCU. The module uses 3.3V power supply and is directly welded on the main controller circuit board.

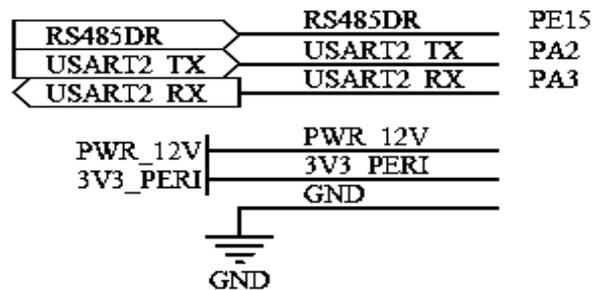


Figure 11. Module interface

In order to ensure the stability of communication, such as the introduction of the protection circuit shown in Fig. 12, D3, D4 two TVS to prevent the surge, RGND was isolated by RS485 module, R13 is used to prevent signal transmission and reflection interference resistance and impedance, signal transmission line of the resistor matching.

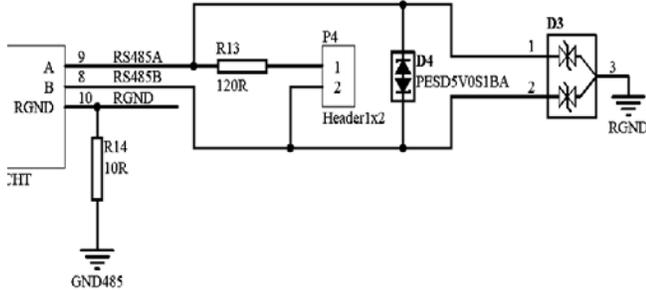


Figure 12. RS485 signal protection circuit

d) Voice module

The voice module using the serial port expansion module on the No. 1 serial port, the audio output power up to 4W, can be directly connected to a small power supply module using 5V horn [6].

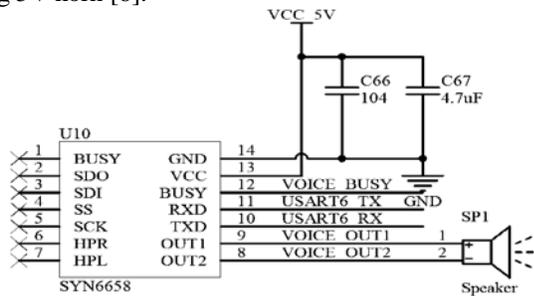


Figure 13. Voice module interface

V. MAIN CONTROLLER SOFTWARE DESIGN

Since the function of the main controller of the system is in addition to the remote control of the server, the user is based on the requirements of the company and the actual situation, the user is divided into the following three categories:

- (1) The minimum permissions, consumers only by password or credit card to pickup
- (2) Distribution, with moderate permissions can be in stock, can also work on the container management
- (3) The administrator permissions, the highest ratio of multi Distribution from mentioning cabinet is provided with system parameters of operating authority

Distribution and administrator passwords corresponding to their respective rights through the operation interface. Container management operations have been described in the first chapter, this is not to say. Since the parameter setting is to ensure that the cabinet from mentioning cabinet system versatility is proposed, including the parameters of staff to modify the password, the self provided number, network parameter modification, refrigerated cabinet system parameter settings and restore factory settings.

Cabinets from mentioning the main controller of the system software is divided into application and drive the two layer, the application layer is responsible for implementation of cabinets from mentioning the main controller of the system entity function, drive and provide software interface for the application layer driver layer responsible for hardware resources of MCU in the configuration and function of each module, application layer by the driver layer, all kinds of operation the user of the top program will change for the application of the function module.

Consumer credit card password administrator distribution pickup RF card screen data entry container inventory management parameter setting and data read or write network communication voice broadcast RS485 commands to send serial expansion of barcode scanning module of GPRS Ethernet module application layer driver layer remote control server.

VI. SYSTEM DEBUGGING AND ANALYSIS

The system debugging and analysis is established in the preparation of the hardware design and the software code based on the end of all, need to verify one by one from mentioning cabinet main controller function. function test from the bottom to the top through testing, functional verification, and from mentioning cabinet system from mentioning cabinet controller to form a complete and stability test, test using the method of multi operation environment and long time operation. The main controller is shown in Fig.14.



Figure 14. Main controller in kind

VII. CONCLUSION

In the future, with the rapid development of science and technology industry convenient, people rely on intelligent products facilities will grow with each passing day intelligent industrial system, instead of the conventional mechanical labor, then, intelligence from mentioning cabinet development will rapidly forward, and more convenient and more intelligent from mentioning cabinet will be pregnant born.

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REFERENCES

- [1] Kang Huaguang. Electronic technology foundation [M]. fifth ed. higher education press, 2006.1.
- [2] Dohler M. cooperative communication: physical layer, channel model and system implementation [M]. Machinery Industry Press, 2011.3.
- [3] LFloyd T. Digital Fundamentals[M]. Tenth Edition. Publishing House of electronics industry, 2014.1.
- [4] Chen Qijun. Embedded system and its application [M]. Shanghai: Tongji University press.2014.
- [5] Feng Ziling.RS485 bus communication protocol design and implementation [J]. Computer Engineering, 2012, 56(10) 50-53.
- [6] Metrologic instruments,Inc.MetroSelect Single-Line Configuration Guide.2007.